

## **REMARKS**

By the present Amendment, claims 11, 19 and 20 are amended. This leaves claims 11-24 pending in the application, with claims 11 and 20 being independent.

### **Rejections Under 35 U.S.C. § 103**

Claim 11 covers a piston accumulator having an accumulator housing 4, a piston 3, a magnet arrangement, and magnet field sensor. The accumulator housing forms a cylindrical tube 1 of magnetizeable material, defines an axial direction along a longitudinal axis 5, and has a gas space 7 and a hydraulic fluid space 9. The piston is axially moveable along a stroke path in the cylindrical tube, and forms a moveable separating element separating spaces 7 and 9 in the housing. Additionally, the piston has radially smaller and larger circumferential sections 21 and 23 spaced from and engaging the longitudinal tube, respectively, and has a radially extending shoulder surface extending between the smaller and larger circumferential sections. The smaller circumferential section 21 is located on the piston end opening on the gas space 7, while the larger circumferential section 23 defines the opposite piston end facing fluid space 9. The magnet arrangement is mounted on the smaller circumferential section of the piston and generates a field on the cylindrical tube. The magnet arrangement includes first and second annular rings 29 and 31 of magnetizeable material and a plurality of magnet elements 35 with pole end surfaces between and abutting the annular rings. The second annular ring is supported by the shoulder surface of the piston in a direction of the hydraulic fluid space. The magnet field sensor is positioned on an exterior of the cylindrical tube and includes a first Hall sensor generating signals representative of piston positions along the stroke path in response to the field generated by the magnet elements.

By forming the piston accumulator in this manner, a simple and effective structure is provided for monitoring the piston position.

Claims 11-18 and 20-24 stand rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 6,346,806 to Schabuble in view of U.S. Patent No. 4,793,241 to Mano, U.S. Patent No. 3,636,824 to Clark and U.S. Patent No. 2,976,845 to Goldring. The Schabuble patent (particularly in Figs. 5-9) is cited for a piston (27, 28) of a magnetizable material that is axially movable within a magnetizable cylindrical tube (29) and that has a smaller circumferential section 28 and a larger circumferential section 27 allegedly spaced from and engaging the tube and with a radial shoulder between them. A magnet arrangement allegedly includes permanent magnets 23 formed as an annular ring 22 mounted between first and second ring elements 25 and 26 of magnetizable material. The ring elements allegedly have an exterior diameter adjacent the magnets spaced from the tube and more remote from the magnets of an exterior diameter approximating the end tube interior diameter. The magnets are allegedly mounted at a radial distance from the piston circumference in a row concentric with the piston longitudinal axis. Hall effect sensors 21 and 21' are allegedly positioned on the cylindrical tube exterior. The piston allegedly divides the tube into two spaces. The reference to an accumulator is deemed to be an intended use and not given patentable weight. The Mano patent is cited for a piston movable in a tube 1 having radially larger and smaller circumferential sections spaced from and engaging the tube, respectively, with a radial shoulder between them, along with a permanent magnet mounted to the piston's smaller section. The Clark patent is cited for a piston 20, 22 and 28 movable within tube 16 and having radially smaller and larger circumferential sections with an arrangement mounted on the smaller section and a threaded ring 28 engaging a threading on the piston to hold the annular rings together on the smaller circumferential section. In support of

the rejection, it is considered obvious to mount the Schabuble magnet arrangement on a smaller piston circumferential, as taught by the Mano patent, with a threaded ring engaging a threading on the piston to hold the rings together on the smaller circumferential section allegedly taught by the Clark patent. The Goldring patent is cited for a piston 27 movable in tube 22 dividing the tube into a gas space and a hydraulic space. In support of the rejection, the Examiner contends that it would be obvious to make the Schabuble first space a gas space and the Schabuble second space a hydraulic fluid space.

Claim 19 stands rejected under 35 U.S.C. §103 as being unpatentable over the Schabuble, Mano, Clark and Goldring patents, when further considered in view of EP 2001 082416. The Examiner appears to be referring to the English language EPO abstract of a Japanese publication previously cited in connection with this application. This EP document cited for a piston 12 movable in a tube 11 and having smaller and larger circumferential sections with an annular magnet arrangement 3 mounted on the smaller section and a seal 16 between the piston and tube. In support of the rejection, it is alleged that it would be obvious to provide a seal in the Schabuble patent in view of the EP document between the second annular ring and the shoulder surface.

Since the recitation of an accumulator is a structural limitation, and not a mere statement of intended use, such structural limitation patentably distinguishes the claims over the cited patents. Also, the cited patents do not disclose or render obvious an accumulator in which a smaller circumferential section mounting the magnet arrangement is located on the end of the piston that opens into a gas space and in which its opposite end is defined by the larger section facing a fluid space.

The Schabuble patent discloses a device for detecting the position of a movable magnet to produce a magnetic field in connection with a piston 27 with a push rod 28. Such device is not an accumulator, and is not disclosed as having a gas space and a hydraulic fluid space, as claimed. Accumulators do not have a push rod as provided in the Schabuble device. Pole shoes 25 and 26 are mounted on the end of the piston opposite the extension of the push rod 28. The Schabuble piston 27 has a constant circumference along its entire axial length such that it does not have larger and smaller circumferential sections, as claimed.

The Mano patent discloses a piston position detector for a fluid pressure cylinder having a ring-shaped permanent magnet 3 with a rectangular cross-sectional configuration fitted in a groove formed on the outer circumference of piston 2. The groove for the magnet is located between and spaced from the axial ends of the piston such that the groove does not open on either piston end. While the portion of the piston having the groove may be interpreted as a radially smaller circumferential section and the two axially ends on the opposite sides of the groove may be viewed as radially larger circumferential sections, the smaller circumferential section is clearly not located on a piston end and opening on a gas space, as claimed.

The Clark patent discloses a filler ring 20 supporting a unitary assembly A with the rings 14a and 14b on a body member 10 mounted in an external annular rabbet 18 and held in place by a nut 28 threaded on end 22a of a reduced end portion of piston rod 24. As such, the Clark patent does not disclose or render obvious a piston with a smaller circumferential section that opens on a gas space and has a magnet arrangement mounted on and about that smaller circumferential section.

While the Goldring patent discloses the device having a gas space and a hydraulic space, it is not an accumulator. Moreover, it does not disclose a piston with larger and smaller

circumferential sections with a magnet arrangement mounted on and about the smaller circumferential section with the smaller circumferential section located on the end of the piston and opening on a gas space.

Since none of the cited patents discloses the specifically claimed smaller circumferential section on a piston end opening on a gas space and on which a magnet arrangement is supported, the four cited patents relied upon and applied in the rejection of claim 11 do not disclose or render obvious the features recited in claim 11. Additionally, the complex and convoluted combination of four patents is indicative of non-obviousness and of an improper hindsight reconstruction of the cited patents in view of the applicant's disclosure.

Accordingly, claim 11 is patentably distinguishable over the cited patents.

Claims 12-18 being dependent upon claim 11, are also allowable for the above reasons. Moreover, these dependent claims recite additional features further distinguishing them over the cited patents. Specifically, the second sensor of claim 20, the permanent magnets and their arrangement of claim 13, the permanent magnets being arranged as recited in claim 14, the configuration of the annular rings of claim 15, the threaded ring of claim 16, the axial positions of the Hall sensors of claim 17, the positioning at the end positions of the stroke path of claim 18, and the sealing element engaging the annular ring and shoulder surface (no such engagement being disclosed in the cited EP publication due to the spaces provided between seal 16 and the shoulder surface and the magnet) of claim 19 are not anticipated or rendered obvious, particularly within the overall claimed combination.

Claim 20 includes the limitations of claim 11, as well as other limitations. This claim is allowable at least for the same reasons advanced above relative to claim 11, and for the seal between and engaging the shoulder and the magnet arrangement admittedly not disclosed in the

four patents applied against claim 20, and not disclosed in the cited EP publication due to the spaces therein. Claims 21-23 are dependent on claim 20, are allowable for the same reasons, and are further distinguished by the additional limitations recited therein.

In view of the foregoing, claims 11-23 are allowable. Prompt and favorable action is solicited.

Respectfully submitted,

  
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Mark S. Biels  
Reg. No. 28,770

Roylance, Abrams, Berdo & Goodman, LLP  
1300 19th Street, NW, Suite 600  
Washington, DC 20036  
(202)659-9076

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